

WHAT IS CLAIMED IS:

1. A current drive apparatus which operates a plurality of loads by applying a current thereto, the current drive apparatus comprising:

5           a plurality of output terminals to which the loads are respectively connected;

          a single current generation circuit which outputs an operating current having a predetermined current value; and

10           a plurality of current storage circuits which are respectively connected to the output terminals, sequentially fetch and hold the operating current, and simultaneously output a drive current based on the operating current to the output terminals.

15           2. The current drive apparatus according to claim 1, wherein the operating current has a current value according to an input signal.

          3. The current drive apparatus according to claim 2, wherein the current generation circuit  
20 comprises:

          a control current generation circuit which generates a control current according to the input signal; and

          an output current generation circuit which  
25 generates and outputs an output current having a predetermined current ratio relative to the control current.

4. The current drive apparatus according to claim 3, wherein the current value of the control current is set larger than a current value of the output current.

5           5. The current drive apparatus according to claim 3, wherein the input signal is a digital signal having a plurality of bits,

            the control current generation circuit comprises a plurality of bit current generation circuits which  
10           generate a plurality of bit currents that current values have weightings corresponding to respective bits of the digital signal, and

            any of the respective bit currents are selected in accordance with a bit value of the input signal, and  
15           the control current is generated by adding the selected bit currents.

            6. The current drive apparatus according to claim 3, wherein the output current generation circuit comprises a current mirror circuit having the  
20           predetermined current ratio.

            7. The current drive apparatus according to claim 1, wherein each of the current storage circuits comprises a voltage component holding section which  
            fetches the operating current outputted from the  
25           current generation circuit and holds a voltage component corresponding to a current value of the operating current.

8. The current drive apparatus according to claim 7, wherein the voltage component holding section has a capacitance element in which electric charges corresponding to the operating current are written.

5        9. The current drive apparatus according to claim 8, wherein the voltage component holding section has a field effect type transistor which causes the operating current to flow between a source and a drain thereof, and

10        the capacitance element has at least a parasitic capacitance between the source and a gate of the field effect type transistor, and a voltage between the source and the gate corresponding to the operating current is written in the capacitance element.

15        10. The current drive apparatus according to claim 9, wherein the mobility of the field effect type transistor has a value which is at least approximately  $200 \text{ cm}^2/\text{Vs}$  or a larger value.

20        11. The current drive apparatus according to claim 7, wherein each of the current storage circuits comprises a drive current generation section which generates and outputs the drive current having a predetermined current ratio relative to the operating current based on the voltage component held in the  
25        voltage component holding section.

12. The current drive apparatus according to claim 11, wherein the drive current generation section

comprises a current mirror circuit having the predetermined current ratio.

13. The current drive apparatus according to claim 1, wherein each of the current storage circuits comprises:

a pair of current storage sections arranged in parallel to each other; and

a control portion which alternately performs an operation to fetch the operating current outputted from the current generation circuit and hold a voltage component corresponding to a current value of the operating current in one current storage section and an operation to output the drive current based on the voltage component held in the other current storage section in parallel.

14. The current drive apparatus according to claim 1, wherein each of the current storage circuits comprises:

current storage sections on a front stage and a rear stage which are arranged in series; and

a control portion which performs an operation to fetch the operating current outputted from the current generation circuit in the current storage section on the front stage, hold a voltage component corresponding to a current value of the operating current and supply a current based on the voltage component to the current storage section on the rear stage and an operation to

fetch the current supplied from the current storage section on the front stage, hold a voltage component corresponding to a current value of the current and output the drive current based on the voltage component in parallel.

15. The current drive apparatus according to claim 1, wherein the drive current has the same current value at the output terminals.

16. The current drive apparatus according to claim 15, which further comprises a single input current storage circuit between the current generation circuit and the plurality of the current storage circuits, and wherein

the input current storage circuit fetches the operating current outputted from the current generation circuit, hold a voltage component corresponding to a current value of the operating current and supplies a current based on the voltage component to the plurality of the current storage circuits.

17. The current drive apparatus according to claim 16, wherein the input current storage circuit has a capacitance element in which electric charges corresponding to the operating current are written as the voltage component.

18. The current drive apparatus according to claim 17, wherein the input current storage circuit has a field effect type transistor which causes the

operating current to flow between a source and a drain thereof, and

the capacitance element has at least a parasitic capacitance between the source and a gate of the field effect type transistor.

19. The current drive apparatus according to claim 16, wherein the input current storage circuit comprises: a pair of input current storage sections arranged in parallel to each other; and  
a control portion which alternately performs an operation to fetch the operating current outputted from the current generation circuit in one of the input current storage sections and hold a voltage component corresponding to a current value of the operating current in one input current storage section, and an operation to supply a current based on a voltage component held in the other input current storage section to the plurality of the current storage circuits in the other input current storage section in parallel.

20. The current drive apparatus according to claim 15, further comprises a pulse width control circuit which is provided between the plurality of the output terminals and the loads and controls a pulse width of the drive current outputted from the output terminals.

21. The current drive apparatus according to

claim 20, wherein the pulse width control circuit controls a pulse width of the drive current in accordance with an input signal.

22. The current drive apparatus according to  
5 claim 1, wherein at least the plurality of the current storage circuits and the output terminals are formed on at least one semiconductor chip.

23. The current drive apparatus according to  
10 claim 22, wherein the single current generation circuit is formed on a semiconductor chip different from the aforesaid semiconductor chip.

24. The current drive apparatus according to  
claim 22, wherein the single current generation circuit is formed in the semiconductor chip.

15 25. A current drive apparatus which operates a plurality of loads by applying a current thereto, the current drive apparatus comprising:

a plurality of output terminals to which the loads are respectively connected;

20 a single reference current generation circuit which generates and outputs a plurality of reference currents having current values different from each other;

25 at least one reference current storage circuit which fetches and holds each of the plurality of reference currents and outputs a plurality of gradation reference currents based on the respective reference

currents;

at least one gradation current generation circuit which selects any of the respective gradation reference currents in accordance with an input signal and

5 generate gradation currents; and

a plurality of current storage circuits which sequentially fetch and hold the respective gradation currents and simultaneously output drive currents based on the gradation currents to the respective output

10 terminals.

26. The current drive apparatus according to claim 25, wherein the single reference current generation circuit comprises a plurality of reference current generation sections which generate and output the respective reference currents and are arranged in parallel to each other.

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27. The current drive apparatus according to claim 26, wherein the input signal is a digital signal having a plurality of bits, and

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current values of the respective reference currents outputted from the respective reference current generation sections have weightings corresponding to respective bits of the digital signal.

28. The current drive apparatus according to claim 25, wherein the reference current storage circuit comprises a plurality of reference current storage sections which individually fetch the respective

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reference currents outputted from the reference current generation circuits, hold voltage components corresponding to the respective reference currents and output the gradation reference currents based on the  
5        respective voltage components.

29. The current drive apparatus according to claim 28, each of the reference current storage circuit sections has a capacitance element in which electric charges corresponding to the reference current are  
10        written as the voltage component.

30. The current drive apparatus according to claim 29, wherein each of the reference current storage circuit sections has a field effect type transistor which causes the operating current to flow between a  
15        source and a drain thereof, and

the capacitance element has at least a parasitic capacitance between the source and a gate of the field effect type transistor.

31. The current drive apparatus according to claim 25, wherein the reference current storage circuit comprises: a pair of reference current storage circuit portions including a plurality of the reference current storage sections which are arranged in parallel; and

a control portion which alternately performs an  
25        operation to fetch the reference current outputted from the reference current generation circuit in one reference current storage circuit portion and hold

a voltage component corresponding to a current value of the reference current, and an operation to output the gradation reference current based on a voltage component held in the other reference current storage  
5 circuit portion.

32. The current drive apparatus according to claim 25, wherein the input signal is a digital signal having a plurality of bits, and

the gradation current generation circuit selects  
10 any of the respective gradation reference currents based on a bit value of the input signal, adds the selected gradation reference currents and generates the gradation current.

33. The current drive apparatus according to  
15 claim 25, wherein the current storage circuit comprises a voltage component holding section which fetches the gradation current outputted from the current generation circuit and holds a voltage component corresponding to a current value of the gradation current.

20 34. The current drive apparatus according to claim 33, wherein the voltage component holding section has a capacitance element in which electric charges corresponding to the gradation current are written as the voltage component.

25 35. The current drive apparatus according to claim 34, wherein the voltage component holding section has a field effect type transistor which causes the

gradation current to flow between a source and a drain thereof, and

the capacitance element has at least a parasitic capacitance between the source and a gate of the field effect type transistor and a voltage between the source and the gate based on the gradation current is written in the capacitance element.

36. The current drive apparatus according to claim 35, wherein the mobility of the field effect type transistor has a value of at least approximately 200 cm<sup>2</sup>/Vs or a larger value.

37. The current drive apparatus according to claim 25, wherein the reference current storage circuit, the current generation circuits, the current storage circuits and the output terminals are formed on at least one semiconductor chip.

38. The current drive apparatus according to claim 37, wherein the reference current generation circuits are formed on a semiconductor chip different from the aforesaid semiconductor chip.

39. The current drive apparatus according to claim 37, wherein the reference current generation circuit is formed in the semiconductor chip.

40. A drive method of a current drive apparatus which operates a plurality of loads connected to a plurality of output terminals by applying to a current thereto, the drive method comprising the step of:

generating an operating current having a predetermined current value by a single current generation circuit and outputting it to a plurality of current storage circuits;

5           sequentially fetching and holding the operating current into the respective current storage circuits; and

             simultaneously outputting a drive current based on the operating current held in the current storage  
10       circuit to the respective output terminals.

             41. The drive method of a current drive apparatus according to claim 40, wherein the step of holding the operating current in the respective current storage circuits and the step of outputting the drive current  
15       to the respective output terminals are executed in parallel.

             42. The drive method of a current drive apparatus according to claim 40, wherein the step of outputting the operating current to a plurality of the current  
20       storage circuits comprises:

             a step of fetching and holding a voltage component corresponding to a current value of the operating current outputted from the current generation circuit to a single input current storage circuit; and

25           a step of supplying a current based on the voltage component held in the input current storage circuit to a plurality of the current storage circuits.

43. A drive method of a current drive apparatus which operates a plurality of loads connected to a plurality of output terminals in a predetermined drive state, the drive method comprising the step of:

5           generating and supplying a plurality of reference currents set in such a manner that current values have weightings different from each other by a single reference current generation circuit;

          fetching and holding the respective reference  
10          currents by the reference current storage circuit and outputting a plurality of gradation reference currents based on the respective reference currents;

          selecting any of the respective gradation  
reference currents in accordance with an input signal  
15          and generating a gradation current; and

          fetching and holding the gradation current and simultaneously outputting a drive current based on the gradation current to the respective output terminals.

44. The drive method of a current drive apparatus  
20          according to claim 43, wherein the reference current storage circuit comprises a pair of reference current storage circuit portion arranged in parallel,

          the step of outputting the gradation reference  
current comprises: a step of fetching the reference  
25          current outputted from the reference current generation circuit and holding a voltage component corresponding to a current value of the reference current in one

reference current storage circuit portion; and a step  
of outputting the gradation reference current based on  
the voltage component held in the other reference  
current storage circuit portion in the other reference  
5 current storage circuit portion in parallel;

the step of holding the voltage component and the  
step of outputting the gradation reference current are  
executed in parallel.

45. A display apparatus which supplies a drive  
10 current according to a display signal to each of  
display pixels of a display panel, and displays image  
information, the display apparatus comprising:

a display panel having a plurality of scanning  
lines arranged in a row direction, a plurality of  
15 signal lines arranged in a column direction and the  
plurality of display pixels which is arranged in the  
vicinity of an intersection of the respective scanning  
lines and signal lines and has an optical element;

a signal drive circuit comprising: a single  
20 current generation circuit which generates and outputs  
an operating current having a current value based on  
the display signal; and a plurality of current storage  
circuits which are provided in accordance with the  
respective signal lines, sequentially fetch the  
25 operating current outputted from the current generation  
circuit and simultaneously output the drive current  
based on the operating current to a plurality of the

signal lines; and

a scanning drive circuit which outputs to each of the plurality of the scanning lines a scanning signal used to sequentially select the display pixel connected to the scanning line.

46. The display apparatus according to claim 45, wherein the current storage circuit comprises a voltage component holding section which fetches the operating current outputted from the current generation circuit and holds a voltage component corresponding to a current value of the operating current.

47. The display apparatus according to claim 46, wherein the voltage component holding section has a capacitance element in which electric charges corresponding to the operating current are written as the voltage component.

48. The display apparatus according to claim 46, wherein the voltage component holding section has a field effect type transistor which causes the operating current to flow between a source and a drain thereof, and

the capacitance element has at least a parasitic capacitance between the source and a gate of the field effect type transistor, and a voltage between the source and the gate based on the operating current is written in the capacitance element.

49. The display apparatus according to claim 48,

wherein the mobility of the field effect type transistor has a value of at least approximately  $200 \text{ cm}^2/\text{Vs}$  or a larger value.

50. The display apparatus according to claim 45,  
5 each of the current storage circuits in the signal drive circuit comprises:

a pair of current storage sections arranged in parallel; and

a control portion which alternately executes an  
10 operation to fetch the operating current outputted from the current generation circuit in one of the current storage sections and hold a voltage component corresponding to a current value of the operating current, and an operation to output the drive current  
15 based on the voltage component held in the other current storage section in parallel.

51. The display apparatus according to claim 45,  
wherein each of the current storage circuits in the signal drive circuit comprises: current storage  
20 sections on a front stage and a rear stage arranged in series; and

a control portion which executes an operation to fetch the operating current outputted from the current generation circuit in the current storage section on  
25 the front stage, hold a voltage component corresponding to a current value of the operating current and supply a current based on the voltage component to the current



storage section on the rear stage, and an operation to  
fetch the current supplied from the current storage  
section on the front stage in the current storage  
section on the rear stage, hold a voltage component  
5 according to a current value of the current and output  
the drive current based on the voltage component in  
parallel.

52. The display apparatus according to claim 45,  
wherein the signal drive circuit comprises a single  
10 input current storage circuit between the current  
generation circuit and the plurality of the current  
storage circuits, and

the input current storage circuit fetches the  
operating current outputted from the current generation  
15 circuit, holds a voltage component corresponding to a  
current value of the operating current and supplies a  
current based on the voltage component to the plurality  
of the current storage circuits.

53. The display apparatus according to claim 52,  
20 wherein the input current storage circuit has a  
capacitance element in which electric charge corre-  
sponding to the operating current are written as the  
voltage component.

54. The display apparatus according to claim 52,  
25 wherein the signal drive circuit further comprises  
a pulse width control circuit which is provided between  
the plurality of the current storage circuits and the

plurality of the signal lines and controls a pulse width of the drive current.

55. The display apparatus according to claim 54, the pulse width control circuit controls a pulse width of the drive current in accordance with an input signal.

56. The display apparatus according to claim 45, wherein at least the plurality of the current storage circuits and the output terminals in the signal drive circuit are formed on at least one semiconductor chip.

57. The display apparatus according to claim 56, wherein the current generation circuit in the signal drive circuit is formed on a semiconductor chip different from the aforesaid semiconductor chip.

58. The display apparatus according to claim 56, wherein the current generation circuit in the signal drive circuit is formed in the semiconductor chip.

59. The display apparatus according to claim 45, wherein the signal drive circuit is configured to include a plurality of semiconductor chips comprising at least the current storage circuits and the output terminals, and

the signal drive circuit has a structure stratified in such a manner the output terminals of the semiconductor chip are sequentially connected to input terminals of a plurality of the semiconductor chips positioned on a next stage.

60. The display apparatus according to claim 45,  
wherein the optical element in the display pixel  
includes a light emitting element.

5 61. The display apparatus according to claim 60,  
wherein the optical element includes an organic  
electroluminescent element.

62. A display apparatus which supplies a drive  
current according to a display signal to each of  
display pixels of a display panel, and displays image  
10 information, the display apparatus comprising:

a display panel comprising: a plurality of  
scanning lines arranged in a row direction; a plurality  
of signal lines arranged in a column direction; and the  
plurality of display pixels which are arranged in the  
15 vicinity of intersections of the respective scanning  
lines and signal lines and have optical elements;

a signal drive circuit comprising: a single  
reference current generation circuit which generates  
and outputs a plurality of reference currents having  
20 current values different from each other; at least one  
reference current storage circuit which fetches and  
holds the respective reference currents and outputs  
a plurality of gradation reference currents based on  
the respective reference currents; at least one  
25 gradation current generation circuit which selects any  
of the respective gradation reference currents in  
accordance with the display signal and generates and

outputs gradation currents; and a plurality of current storage circuits which are provided in accordance with the respective signal lines, sequentially fetch and hold the gradation currents outputted from the

5 gradation current generation circuit and simultaneously output drive currents based on the gradation currents to a plurality of the signal lines; and

a scanning drive circuit which outputs to the respective scanning lines a scanning signal used to sequentially select the display pixels connected to the scanning lines.

63. The display apparatus according to claim 62, wherein the reference current generation circuit comprises a plurality of reference current generation sections which generate and output the respective reference currents and are arranged in parallel.

64. The display apparatus according to claim 63, wherein the display signal is a digital signal having a plurality of bits, and

20 current values of the respective reference currents outputted from the respective reference current generation section have weightings corresponding to respective bits of the digital signal.

65. The display apparatus according to claim 62, wherein the display signal is a digital signal having a plurality of bits, and

the gradation current generation circuit selects

any of the respective gradation reference currents based on a bit value of the display signal, adds the selected gradation reference currents, and generates the gradation currents.

5           66. The display apparatus according to claim 62, wherein the reference current storage circuit comprises: a pair of reference current storage circuit portions which are arranged in parallel and each of which includes a plurality of the reference current  
10           storage sections; and  
            a control portion which alternately execute an operation to fetch the reference currents outputted from the reference current generation circuits in one of the reference current storage circuit portions and  
15           hold voltage components corresponding to current values of the reference currents and an operation to output the gradation reference currents based on the voltage component held in the other reference current storage circuit portion in parallel.

20           67. The display apparatus according to claim 62, wherein the current storage circuit comprises a voltage component holding section which fetches the gradation currents outputted from the current generation circuits and holds voltage components corresponding to current  
25           values of the gradation currents.

            68. The display apparatus according to claim 65, wherein the voltage component holding section has

a capacitance element in which electric charges corresponding to the operating current are written.

69. The display apparatus according to claim 68, wherein the voltage component holding section has a  
5 field effect type transistor which causes the operating current to flow between a source and a drain thereof, and

the capacitance element has at least a parasitic capacitance between the source and a gate of the  
10 electric field type transistor, and a voltage between the source and the gate based on the operating current is written in the capacitance element.

70. The display apparatus according to claim 69, wherein the mobility of the field effect type  
15 transistor has a value of at least approximately  $200 \text{ cm}^2/\text{Vs}$  or a larger value.

71. The display apparatus according to claim 62, wherein at least the reference current storage circuit, the current generation circuit, the plurality of  
20 current storage circuits and the output terminals in the signal drive circuit are formed on at least one semiconductor chip.

72. The display apparatus according to claim 71, wherein the reference current generation circuit in the  
25 signal drive circuit is formed on a semiconductor chip different from the aforesaid semiconductor chip.

73. The display apparatus according to claim 72,

wherein the reference current generation circuit in the signal drive circuit is formed in the semiconductor chip.

74. The display apparatus according to claim 62,  
5 wherein the signal drive circuit is configured to include a plurality of semiconductor chips including at least the current storing means and the output terminals, and

the signal drive circuit has a structure  
10 stratified in such a manner that the output terminals of the semiconductor chip are sequentially connected to input terminals of a plurality of the semiconductor chips positioned on a next stage.

75. The display apparatus according to claim 62,  
15 wherein the optical element in the display pixel includes a light emitting element.

76. The display apparatus according to claim 75,  
wherein the optical element includes an organic electroluminescent element.